

EXHIBIT A

**IN THE UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF ALABAMA**

KENNETH EUGENE SMITH)	
)	
Plaintiff,)	
)	Case No. 2:23-cv-00656-RAH
v.)	
)	CAPITAL CASE
JOHN Q. HAMM, Commissioner, Alabama)	
Department of Corrections, and)	EXECUTION SCHEDULED FOR
)	JANUARY 25, 2024
TERRY RAYBON, in his official)	
Capacity as Warden, Holman)	
Correctional Facility,)	
)	

**DECLARATION OF ROBERT JASON YONG, M.D. IN SUPPORT OF MOTION FOR
PRELIMINARY INJUNCTION**

I, Robert Jason Yong, declare under penalty of perjury as follows:

I have been asked by Arnold & Porter to provide an expert review on nitrogen hypoxia. Specifically, in preparing this report, I have referenced textbooks, journal articles, guidelines, and the Alabama Department of Corrections' Execution Protocol for Nitrogen Hypoxia dated August 2023 (the Protocol). I also rely on my medical training and clinical experience as an anesthesiologist. My expert opinions on the subject are set forth below. All the opinions stated in this medical report are stated to a reasonable degree of medical certainty.

I. Qualifications

I am the Chief of Pain Medicine and serve as the Medical Director of the Pain Management Center at Brigham and Women's Hospital in Boston, Massachusetts, which is affiliated with Harvard Medical School. I am on the faculty of Harvard Medical School, where I am an Assistant Professor in Anesthesia. In 2014, 2015, 2016, 2018, 2020, 2021, and 2023, I was awarded the Pain Attending of the Year Award for the Department of Anesthesiology at Brigham and Women's

Hospital. Prior to this, I was an Assistant Professor at Johns Hopkins Hospital in Baltimore, Maryland, where I was awarded Outstanding Teacher of the Year, Department of Anesthesiology in 2013.

I obtained my Medical Degree from Baylor College of Medicine. I completed my residency in anesthesiology, perioperative medicine, and pain medicine at Brigham and Women's Hospital, Harvard Medical School. As a resident at Brigham and Women's Hospital, I received recognition as the Distinguished Resident of the Year and was selected as a Foundation for Anesthesia Education and Research (FAER) Practice Management Scholar. During my last year of residency, I was elected as a Chief Resident of the Anesthesiology Department. Following residency, I completed a fellowship in Pain Medicine at Brigham and Women's Hospital, Harvard Medical School. I am licensed to practice medicine in Massachusetts and double-board certified in Anesthesiology and Pain Management.

I have significant expertise with the subject matter of this case. I have substantial knowledge, training, and experience in the physiology and pathophysiology of the respiratory system and ventilation. I have over 10 years of experience managing the airways of patients while monitoring and managing their ventilation. As an anesthesiologist managing adequate oxygen levels around the time of surgery is paramount, and I have developed substantial experience monitoring and maintaining oxygen levels. I have a deep understanding of physiology and pharmacology with board certification in Anesthesiology.

Attached as Exhibit 1 is a list of references considered in preparing my report. My CV is attached hereto as Exhibit 2.

I reserve the right to supplement or amend my opinions based upon any new information or medical literature that subsequently becomes available to me. I further reserve the right to

comment on any opinions offered by defendants' experts submitted in briefing, or at deposition or hearings. In addition, I reserve the right to discuss general concepts within the field of Anesthesiology to provide context for any of the opinions discussed in this report. Finally, I reserve the right to use graphics or demonstratives at hearings to illustrate the concepts discussed in my report.

I submit this Declaration in support of Kenneth Eugene Smith's Motion for Preliminary Injunction.

II. Background

A. Anatomy and Physiology

The human circulatory system or cardiovascular system allows the flow of blood throughout the body. The blood transports nutrients and oxygen to the tissues and carries carbon dioxide and waste products away to be metabolized or excreted. The heart serves as the main pump moving blood to the vital organs, including the heart, lungs, kidneys, liver, and brain¹.

The human respiratory system allows the exchange of vital gasses via the lungs into the bloodstream². The gasses enter the respiratory system via the nose or mouth and pass through the trachea before branching into the bronchi then bronchioles and finally the alveoli. The blood from the right side of the heart pumps into the lungs and back to the left side of the heart before circulating through the rest of the body. As blood flows from the heart to the lungs, the blood vessels branch into smaller and smaller vessels ending as capillaries that surround the alveoli. It is at the level of the alveoli that gasses are exchanged from the air to the blood stream.

¹ InformedHealth.org [Internet]. Cologne, Germany: Institute for Quality and Efficiency in Health Care (IQWiG); 2006-. How does the blood circulatory system work? 2010 Mar 12 [Updated 2019 Jan 31]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK279250/>

² Patwa A, Shah A. Anatomy and physiology of respiratory system relevant to anaesthesia. Indian J Anaesth. 2015 Sep;59(9):533-41. doi: 10.4103/0019-5049.165849. PMID: 26556911; PMCID: PMC4613399.

Inspired room air is comprised of nitrogen (~78%), oxygen (~21%), argon (~0.9%), carbon dioxide (0.035%), and other gasses. The gradient of particular gasses in the alveoli compared to the bloodstream allows for gasses to be exchanged from the air to the blood. In normal states, oxygen is delivered to the blood and carbon dioxide is taken out of the blood.

The cells in humans require the oxygen for normal physiologic functioning³. Hypoxemia describes a condition in which there is a lower-than-normal level of oxygen in the blood. It occurs when the oxygen saturation in the bloodstream is below the expected or necessary levels for the body to function correctly. Hypoxia describes a state in which the cells have insufficient oxygen to maintain normal functioning, while hypoxemia refers specifically to low oxygen levels in the blood. An individual experiencing hypoxemia or hypoxia is still capable of exhaling carbon dioxide. By contrast, asphyxia describes the inability to inhale oxygen and the inability to exhale carbon dioxide. Being unable to exhale excess carbon dioxide leads to a higher-than-normal level of carbon dioxide in the blood, a state known as hypercarbia. Asphyxia, and resulting hypercarbia, can lead to the distressing physical sensation of suffocation.

B. Nitrogen hypoxemia

Nitrogen hypoxemia is a condition that can occur when a person is exposed to very high- or very low-pressure environments, such as deep-sea diving or high-altitude locations. Nitrogen hypoxemia occurs when the increased pressure causes the body to take in more nitrogen than usual, which can dilute the amount of oxygen available for the body's tissues and cells. This can lead to a decrease in the body's oxygen levels, resulting in symptoms like dizziness, confusion, shortness of breath, and, in severe cases, even loss of consciousness.

³ Ortiz-Prado E, Dunn JF, Vasconez J, Castillo D, Viscor G. Partial pressure of oxygen in the human body: a general review. *Am J Blood Res.* 2019 Feb 15;9(1):1-14. PMID: 30899601; PMCID: PMC6420699.

Insufficient blood oxygen (hypoxemia) leads to tissue damage and catastrophic damage to vital organs⁴. There are many causes of hypoxemia including anemia, acute respiratory distress syndrome, heart failure, etc. The brain has substantial energy demands, making it particularly susceptible to the effects of low oxygen in its cells (hypoxia). Despite its small size relative to the entire body, the brain consumes a significant portion of the oxygen supply (approximately 20%). Normally, when the brain requires more oxygen, the body responds by increasing blood flow to meet this demand. However, both hypoxemia and reduced blood supply (ischemia) can result in damage to the brain. The longer the brain is deprived of adequate oxygen or blood flow, the more extensive and widespread the resulting damage becomes. Specific regions of the brain, including the brainstem, hippocampus, and cerebral cortex, are particularly vulnerable to this type of injury. This damage can become permanent unless oxygen levels are promptly restored. When oxygen levels are insufficient, brain cells can undergo cell death, primarily through a process called necrosis, and delayed cell death known as apoptosis may also occur⁵. Environments deficient in oxygen can result in nausea, vomiting, dizziness, confusion, and impaired judgement⁶.

Breathing in 100% nitrogen gas would result in hypoxemia, eventual end-organ damage, and ultimately death. However, there is a lack of data regarding exactly how long a person must be exposed to 100% nitrogen to lead to death, or what happens at exposures to slightly less than 100% nitrogen for prolonged periods of time. As noted below, if a person is exposed to less than 100% nitrogen, there is a risk that the person could transition to a persistent vegetative state, have a stroke, or experience the painful sensation of suffocation instead of dying.

⁴ Michiels C. Physiological and pathological responses to hypoxia. *Am J Pathol.* 2004 Jun;164(6):1875-82. doi: 10.1016/S0002-9440(10)63747-9. PMID: 15161623; PMCID: PMC1615763.

⁵ Michiels C. Physiological and pathological responses to hypoxia. *Am J Pathol.* 2004 Jun;164(6):1875-82. doi: 10.1016/S0002-9440(10)63747-9. PMID: 15161623; PMCID: PMC1615763.

⁶ Harding BE, Wolf BC. Case report of suicide by inhalation of nitrogen gas. *Am J Forensic Med Pathol.* 2008 Sep;29(3):235-7. doi: 10.1097/PAF.0b013e318183240c. PMID: 18725778.

C. Challenges with nitrogen hypoxemia

a. Challenges With Using Masks To Administer Gas

During administration of anesthetics in the operating room, the anesthesiologist's job is to reduce the risk that a patient experiences hypoxemia before the anesthesia becomes fully effective. In a clinical setting, patients are typically "pre-oxygenated" before receiving anesthesia: The mask is filled with 100% oxygen to flood the body's cells with oxygen. After pre-oxygenation, the patient can be delivered anesthesia via the mask or intravenously. Once the patient is no longer able to breathe independently, the anesthesiologist mask-ventilates the patient for the duration of the anesthesia.

When pre-oxygenating a patient, the priority is on ensuring the mask has a tight fit to make sure there is no leakage and that the maximum amount of oxygen is delivered to the patient. Masks generally come in a few sizes. Oftentimes, mask ventilation can be difficult if the mask does not appropriately fit⁷. Variations in nose structure, facial hair, obesity, and other anatomic variability can increase the difficulty of mask ventilation.

While mask ventilating a patient during anesthesia, the most common set-up places the anesthesiologist's left hand on the mask securing it to the patient's face and the right hand on the ventilation bag. The left hand is positioned such that the thumb is on the upper portion of the mask placing downward pressure on the nasal bridge, the pointer and middle fingers are placed on the lower portion of the mask placing downward pressure on the chin, and the ring finger and pinky are positioned on the patient's jaw or mentum applying upward pressure against the mask to create a tight seal. In a clinical setting, the anesthesiologist is close to the patient, holding the mask in

⁷ Kapoor MC, Rana S, Singh AK, Vishal V, Sikdar I. Nasal mask ventilation is better than face mask ventilation in edentulous patients. J Anaesthesiol Clin Pharmacol. 2016 Jul-Sep;32(3):314-8. doi: 10.4103/0970-9185.168262. PMID: 27625477; PMCID: PMC5009835.

position and, at times, manually squeezing the ventilation bag. If there is a poor mask seal, the anesthesiologist would be in a position to feel air leaking out around the mask.

An alternative set-up utilizes straps around the back of the patient's head that attach to the mask and secure it to the patient's face without the anesthesiologist needing to hold the mask in place manually. Straps can be used if the patient is cooperative and has normal anatomy. However, if a patient resists or turns their head the mask can be dislodged or the seal broken. Because of these limitations with straps, the preferred practice is to have the anesthesiologist hold the mask.

In addition to pre-oxygenating a patient, masks are sometimes used in clinical practice to apply anesthesia directly. The mask is fitted to a person while they are conscious (whether by straps or otherwise), and then the person loses consciousness, which causes changes to the face as the facial muscles relax. These facial changes can cause the mask to dislodge or the seal to be broken. In a clinical setting, an anesthesiologist will be able to adjust their hand position or adjust the mask as the patient loses consciousness to ensure the seal is not broken. Additionally, when administering anesthesia, a broken seal that allows for the incursion of some oxygen entering the patient's mask is acceptable because the goal is not to completely limit the patient's oxygen levels.

Anesthesiology breathing circuits that have inspiratory and expiratory elements contain a "scrubber," an apparatus to eliminate carbon dioxide from the mask when the patient exhales (see Figure 1 below). Regardless of what mix of gasses a person inhales through a breathing circuit, normal physiological processes mean that a person will always continue to exhale carbon dioxide. Scrubbing carbon dioxide from the patient's air is essential to avoid re-breathing exhaled carbon dioxide, which could cause asphyxiation, hypercarbia, and the sensation of suffocation. The scrubber removes carbon dioxide from the mask by absorbing and storing it; a common carbon

dioxide-specific absorber is soda lime, a combination of sodium hydroxide and calcium hydroxide. Without a mechanism to remove carbon dioxide, a person may experience asphyxiation and the sensation of suffocation.

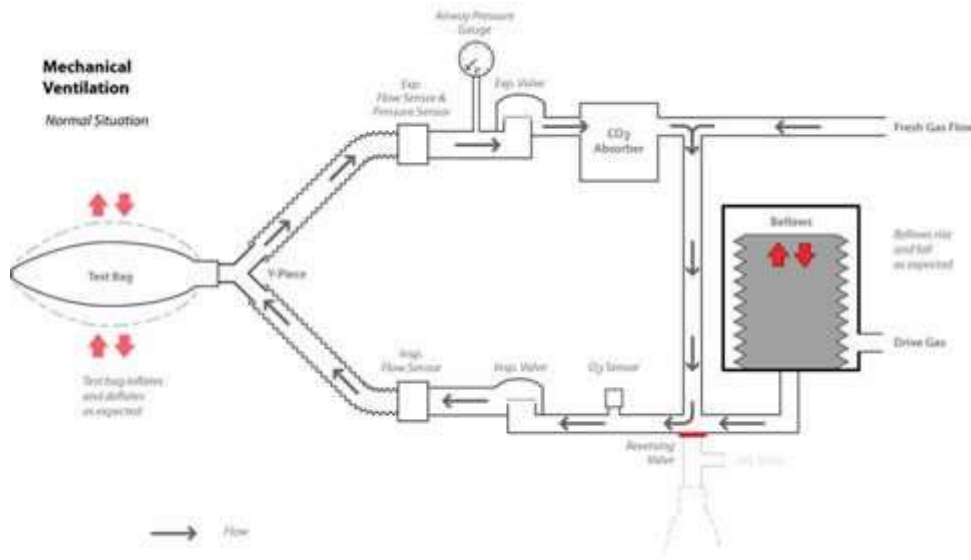


Figure 1: Example of carbon dioxide “scrubber” in a mechanical ventilation system with inspiratory and expiratory elements⁸.

If a patient vomits into a mask during the administration of anesthesia, anesthesiologists use suction to remove any vomit from inside the mask. Often this requires removing the mask in order to properly suction out all material, to ensure the patient does not inhale and choke on their own vomit. The mask would then be cleaned or exchanged for a new mask.

b. Alabama Department of Corrections’ Execution Protocol for Nitrogen Hypoxia

I have reviewed a redacted copy of the Protocol and the accompanying spiritual advisor waiver form. While the Protocol is heavily redacted, making it difficult to assess the complete

⁸ George Mychaskiw II, Scott C. Carriker, Richard G. Cipolli, Measurement of Expiratory Limb Circuit Pressure: A Potential Anesthesia Machine Safety Issue, 25 Anesthesia Patient Safety Foundation Newsletter 2 (Summer 2010), <https://www.apsf.org/article/measurement-of-expiratory-limb-circuit-pressure-a-potential-anesthesia-machine-safety-issue/>.

process, based on the information provided I have identified several areas of concern. Each concern could result in the condemned person being transitioned to a persistent vegetative state, having a stroke, experiencing the painful sensation of suffocation, choking on aspirated vomit, or other complications if not properly rectified.

First, the Protocol does not provide adequate detail on the mechanism of delivery of the nitrogen or how a mask would be maintained in position throughout the process. If protocols are designed based on normal, standard operating procedures for the delivery of gasses, then there is likely an assumption of patient compliance and minimal movement. Without patient compliance and minimal movement, it is difficult to ensure that a mask will remain sealed and in the correct position.

Delivery of nitrogen gas would require a closed chamber or a tightly sealed mask. The Protocol provides little information on what is being done to secure the mask and confirm a tight seal. The Protocol notes that a mask will be placed and adjusted on the condemned person's face and that there will be a final inspection of the mask, but there is no information on how this will be done, the training of the persons(s) performing the inspection, what the inspection is looking for, and what (if anything) will be done if the team determines there is not a closed seal. The movement of the condemned person while speaking or otherwise moving their head, including small mouth movements such as quiet but audible prayer, along with changes to the facial muscles when they lose consciousness, may result in an imperfect seal resulting in leaking. The Protocol calls for the condemned person to give his final statement after the mask has been placed on him. Following the final statement, the Protocol indicates that team members will conduct a final inspection of the mask to verify proper placement. However, there is no information about how the team will monitor the seal of the mask once the nitrogen hypoxia system is activated.

If a mask does not fit or the chamber is not completely closed, entrainment of room air can occur allowing for some oxygen to be inspired. A mandatory waiver for spiritual providers remaining in the room highlights the possibility that nitrogen could leak into the room during the execution. If nitrogen can leak out of the mask, that would inversely mean that room air containing oxygen could be entrained into the mask. In the hospital setting, small amount of oxygen entering the patient's mask is acceptable because the patient is receiving breathable air. In contrast, in an execution by nitrogen hypoxia setting, breathing oxygen would likely prolong the time to reach unconsciousness which could lead to a persistent vegetative state or other complications.

In addition to a tight seal, a mask system must include a scrubber to remove carbon dioxide from the air the condemned person exhales. The Protocol does not specify whether the mask includes a carbon dioxide scrubber or any other mechanism to remove excess carbon dioxide. If the mask does not include a scrubber, the condemned person could re-breathe carbon dioxide and experience hypercarbia, asphyxiation, and the painful sensation of suffocation.

Second, the Protocol does not take into account what will happen if the condemned person vomits into the mask or has a seizure. As noted above, environments deficient in oxygen can result in nausea and vomiting. If vomit is not cleared from the mask, the condemned person could inhale the vomit and asphyxiate, resulting in painful physical sensations of choking and suffocation. The Protocol provides no instructions for clearing vomit out of the mask.

The Protocol also does not specify what should be done in the event of a seizure, either to ensure the mask remains secured to the condemned person's face despite the rapid movements associated with seizures or to identify criteria to stop the process of nitrogen administration if there is a risk the condemned person will not die but rather enter a persistent vegetative state or other damage short of death. Given the lack of data on nitrogen hypoxemia, the risk of vomiting or

seizure is unknown. However, the fact that the Protocol does not account for any risk of vomiting or seizure further indicates that the current Protocol is insufficient for humane administration of nitrogen hypoxia.

Third, the Protocol does not specify the purity of the nitrogen gas to be used. To the extent, the Protocol calls for anything less than 100% nitrogen gas then the condemned may transition to a persistent vegetative state, have a stroke, experience the painful sensation of suffocation or suffer other complications. Likewise, there is no discussion on what testing is performed to ensure purity of the gas being used, nor is there any information on where the nitrogen is sourced and how it is transported or stored. In a clinical setting, when we provide oxygen or any other type of gas to a patient, there are procedures in place to confirm the quality of the product and make sure it is transported and stored in an appropriate manner to avoid problems such as possible contamination.

Fourth, the Protocol does not provide for continued monitoring of blood oxygen levels or the condemned person's heart rate as the nitrogen is being administered, in order to assess whether the blood oxygen levels are reducing as planned. The Protocol states that a pulse oximeter, which reads blood oxygen levels, will be affixed to the condemned person before administration of nitrogen and will be monitored for two minutes. However, the Protocol provides no information on how blood oxygen levels or the condemned person's heart rate will be monitored *after* administration of nitrogen begins. Nor does the Protocol establish criteria for shutting down the nitrogen hypoxia system if the condemned person's blood oxygen or pulse gets low but not low enough to cause death. Given the lack of scientific data about blood oxygen levels necessary to cause death, the Protocol's failure to monitor blood oxygen levels and heart rate after nitrogen administration puts the condemned person at risk of entering a permanent vegetative state or experiencing other physiological damage short of death.

Lastly, there is a dearth of research regarding pain or sensations felt during nitrogen hypoxemia, and major questions remain for how long to administer 100% nitrogen before death occurs. The American Veterinary Medical Association (AVMA) has determined nitrogen hypoxia is acceptable for euthanasia of pigs but “is unacceptable for other mammals.”⁹ According to the AVMA euthanasia guidelines, nitrogen “create[s] an anoxic environment that is distressing for some species.”¹⁰ If incomplete or unsuccessful, one potential outcome is a transition to a persistent vegetative state.

D. Sensation of Suffocation

Suffocation refers to the state or process of dying as a result of being asphyxiated, which occurs when a person can neither inhale oxygen nor exhale carbon dioxide. An inability to rid the body of excess carbon dioxide leads to an accumulation of carbon dioxide in the blood (hypercarbia). When blood carbon dioxide levels rise too high, the blood pH levels become more acidic in a process called respiratory acidosis. The physical sensations associated with respiratory acidosis include anxiety, confusion, headache, drowsiness, and stupor¹¹.

E. Persistent Vegetative State

A persistent vegetative state (PVS) is a medical condition characterized by a profound and long-lasting loss of consciousness and cognitive function¹². In PVS, individuals appear to be awake but lack awareness of themselves or their surroundings. They may have cycles of sleep and

⁹ American Veterinary Medical Association, AVMA Guidelines for the Euthanasia of Animals: 2020 Edition, at 28.

¹⁰ American Veterinary Medical Association, AVMA Guidelines for the Euthanasia of Animals: 2020 Edition, at 28.

¹¹ James L. Lewis III. Respiratory Acidosis. Merck Manual: Professional Version (Jul. 2023), <https://www.merckmanuals.com/professional/endocrine-and-metabolic-disorders/acid-base-regulation-and-disorders/respiratory-acidosis>.

¹² Zeman A. Persistent vegetative state. Lancet. 1997 Sep 13;350(9080):795-9. doi: 10.1016/S0140-6736(97)06447-7. PMID: 9298013.

wakefulness but do not exhibit purposeful responses to their environment or communicate in meaningful ways.

People in a persistent vegetative state experience significant damage to the cerebral cortex, the part of the brain responsible for conscious thought, perception, and decision-making. This damage results in the loss of cognitive functions like awareness, reasoning, and memory. Despite the loss of higher brain functions, individuals in a PVS may retain some basic bodily functions such as breathing, digestion, and reflexes. They may appear to move, make noises, or even open their eyes, but these actions are typically involuntary and not indicative of consciousness. The prognosis for individuals in a persistent vegetative state is generally poor. While some may recover partially or regain minimal awareness, many do not show significant improvement over time. PVS is often considered a long-term or permanent condition. The care of patients in PVS requires feeding, bathing, housing, and the personnel required to carry out those tasks. Costs of caring for individuals in a persistent vegetative state are estimated to be >\$90,000 per year¹³.

F. Stroke

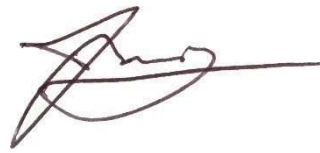
If the patient does not develop PVS, an alternative scenario would be the development of a stroke where part of the brain is damaged. Depending on the area damaged, the residual effect could be failure of speech, movement of limbs, alterations of any of the senses, and much more. On average, the lifetime cost of stroke per person is estimated to be >\$100,000¹⁴.

¹³ Fields AI, Coble DH, Pollack MM, Cuerdon TT, Kaufman J. Outcomes of children in a persistent vegetative state. *Crit Care Med*. 1993 Dec;21(12):1890-4. doi: 10.1097/00003246-199312000-00016. PMID: 8252894.

¹⁴ Taylor TN, Davis PH, Torner JC, Holmes J, Meyer JW, Jacobson MF. Lifetime cost of stroke in the United States. *Stroke*. 1996;27:1459–1466. <https://doi.org/10.1161/01.STR.27.9.1459>. See also Johnson BH, Bonafede MM, Watson C. Short- and longer-term health-care resource utilization and costs associated with acute ischemic stroke. *Clinicoecon Outcomes Res*. 2016; 8:53-61. doi: 10.2147/CEOR.S95662. PMCID: PMC4770080. PMID: 26966382. (estimating \$140,048 lifetime cost for ischemic strokes).

My engagement is ongoing, and should any additional material information become available to me, I reserve the right to modify or supplement my conclusions and opinions. The opinions expressed in this Declaration are my own and are made to a reasonable degree of medical certainty. I declare under penalty of perjury that the foregoing is true and correct under 28 U.S.C. § 1746.

Executed on this 17th day of November 2023,

A handwritten signature in dark ink, appearing to read 'R. Jason Yong', with a long horizontal line extending to the right.

R. Jason Yong, MD MBA

EXHIBIT 1

Exhibit 1: Materials Considered List

Alabama Department of Corrections, Execution Protocol for Nitrogen Hypoxia (Aug. 2023).
American Veterinary Medical Association, AVMA Guidelines for the Euthanasia of Animals: 2020 Edition, at 28.
Committee on Standards and Practice Parameters, Standards for Basic Anesthetic Monitoring, American Society of Anesthesiologists (Dec. 13, 2020), https://www.asahq.org/standards-and-practice-parameters/standards-for-basic-anesthetic-monitoring .
Fields AI, Coble DH, Pollack MM, Cuerdon TT, Kaufman J. Outcomes of children in a persistent vegetative state. Crit Care Med. 1993 Dec;21(12):1890-4. doi: 10.1097/00003246-199312000-00016. PMID: 8252894.
George Mychaskiw II, Scott C. Carriker, Richard G. Cipolli, Measurement of Expiratory Limb Circuit Pressure: A Potential Anesthesia Machine Safety Issue, 25 Anesthesia Patient Safety Foundation Newsletter 2 (Summer 2010), https://www.apsf.org/article/measurement-of-expiratory-limb-circuit-pressure-a-potential-anesthesia-machine-safety-issue/ .
Harding BE, Wolf BC. Case report of suicide by inhalation of nitrogen gas. Am J Forensic Med Pathol. 2008 Sep;29(3):235-7. doi: 10.1097/PAF.0b013e318183240c. PMID: 18725778.
InformedHealth.org [Internet]. Cologne, Germany: Institute for Quality and Efficiency in Health Care (IQWiG); 2006-. How does the blood circulatory system work? 2010 Mar 12 [Updated 2019 Jan 31]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK279250/
James L. Lewis III, Respiratory Acidosis, Merck Manual: Professional Version (Jul. 2023), https://www.merckmanuals.com/professional/endocrine-and-metabolic-disorders/acid-base-regulation-and-disorders/respiratory-acidosis .
Johnson BH, Bonafede MM, Watson C. Short- and longer-term health-care resource utilization and costs associated with acute ischemic stroke. Clinicoecon Outcomes Res. 2016; 8:53-61. doi: 10.2147/CEOR.S95662. PMCID: PMC4770080. PMID: 26966382. (estimating \$140,048 lifetime cost for ischemic strokes).
Kapoor MC, Rana S, Singh AK, Vishal V, Sikdar I. Nasal mask ventilation is better than face mask ventilation in edentulous patients. J Anaesthesiol Clin Pharmacol. 2016 Jul-Sep;32(3):314-8. doi: 10.4103/0970-9185.168262. PMID: 27625477; PMCID: PMC5009835.
Michiels C. Physiological and pathological responses to hypoxia. Am J Pathol. 2004 Jun;164(6):1875-82. doi: 10.1016/S0002-9440(10)63747-9. PMID: 15161623; PMCID: PMC1615763.
Morgan & Mikhail's Clinical Anesthesiology (John F. Butterworth IV, et al., eds., 7th ed. 2022).

Ortiz-Prado E, Dunn JF, Vasconez J, Castillo D, Viscor G. Partial pressure of oxygen in the human body: a general review. *Am J Blood Res*. 2019 Feb 15;9(1):1-14. PMID: 30899601; PMCID: PMC6420699.

Patwa A, Shah A. Anatomy and physiology of respiratory system relevant to anaesthesia. *Indian J Anaesth*. 2015 Sep;59(9):533-41. doi: 10.4103/0019-5049.165849. PMID: 26556911; PMCID: PMC4613399.

Stoelting's Anesthesia and Co-Existing Disease (Roberta L. Hines & Stephanie B. Jones, eds., 8th ed. 2022).

Taylor TN, Davis PH, Torner JC, Holmes J, Meyer JW, Jacobson MF. Lifetime cost of stroke in the United States. *Stroke*. 1996;27:1459–1466. <https://doi.org/10.1161/01.STR.27.9.1459>.

Zeman A. Persistent vegetative state. *Lancet*. 1997 Sep 13;350(9080):795-9. doi: 10.1016/S0140-6736(97)06447-7. PMID: 9298013.

EXHIBIT 2

**The Faculty of Medicine of Harvard University
Curriculum Vitae**

Date Prepared: November 17, 2023

Name: Robert Jason Yong

Office Address: Brigham and Women's Hospital
Department of Anesthesiology, Perioperative and Pain Medicine
75 Francis Street
Boston, MA 02115

Home Address: [REDACTED]

Work Phone: 617-983-7080

Work Email: ryong@bwh.harvard.edu

Education:

1998-2002	BA	Biology	University of Texas, Austin, TX
2002-2007	MD	Medicine	Baylor College of Medicine, Houston, TX
2004-2006	MBA	Business Administration	Rice University, Jones Graduate School of Management, Houston, TX

Postdoctoral Training:

2007-2008	Intern	General Surgery	Beth Israel Deaconess Medical Center
2008-2011	Resident	Anesthesiology	Brigham and Women's Hospital
2010-2011	Chief Resident	Department of Anesthesia	Brigham and Women's Hospital
2011-2012	Fellow	Pain Management	Brigham and Women's Hospital

Faculty Academic Appointments:

2012-2013	Assistant Professor	Anesthesia	Johns Hopkins Medical School, Baltimore, MD
2013-2019	Instructor	Anaesthesia	Harvard Medical School, Boston, MA
2019-	Assistant Professor	Anaesthesia	Harvard Medical School, Boston, MA

Appointments at Hospitals/Affiliated Institutions:

2012-2013	Attending	Anesthesia	Johns Hopkins Hospital
2013-	Attending	Anesthesia	Brigham & Women's Hospital

Other Professional Positions:

2016-2020	Scientific Advisory Board	axialHealthcare	12 days per year
2016-	Consultant	Medtronic	2 days per year
2017-	Consultant	Nevro	2 days per year
2019-2021	Consultant	Endo Pharmaceuticals	12 days per year
2019-	Consultant	Abbott	2 days per year

Major Administrative Leadership Positions:

Local

2013-2017	Founding Medical Director of Pain Management	Brigham and Women's Faulkner Hospital
2013-	Founding Co-Director, Spine Center	Brigham and Women's Faulkner Hospital
2014-2021	Associate Program Director of Pain Management	Brigham and Women's Hospital
2014-	Co-founder and Facilitator: Fellow Lecture Series	Brigham and Women's Faulkner

2017-	Medical Director of Pain Management Center	Brigham and Women's Hospital
2020-2021	Associate Chief of Pain Medicine Division	Brigham and Women's Hospital
2021-2023	Chief of Pain Medicine Division	Brigham and Women's Hospital
2023-	Associate Chief of Pain Medicine Division	Brigham and Women's Hospital

Committee Service:**Local**

2010-2011	Residency Admissions Interview Committee	Department Anesthesiology, Brigham and Women's Hospital
2012-2013	Residency Admissions Interview Committee	Department Anesthesiology, Johns Hopkins Hospital
2013-2015	Medical Executive Committee	Brigham and Women's Faulkner
2013-	Fellowship Admissions Interview Committee	Brigham and Women's Hospital
2014-	Ambulatory Advisory Council	Brigham and Women's Faulkner
2014-	Pain Fellowship Clinical Competency Committee	Brigham and Women's Hospital
2014-	Program Evaluation Committee	Brigham and Women's Hospital
2015-2018	Opioid Management Subcommittee	Brigham and Women's Faulkner
2015-2019	Opiate Ad Hoc Committee	Harvard Medical School
2016-2020	Office for Multicultural Careers Advisory Committee	Brigham and Women's Hospital
2016-	B CORE Standards Committee	Brigham and Women's Faulkner
2017-	Residency Admissions Committee	Brigham and Women's Hospital

2017-	Residency Clinical Competency Committee	Brigham and Women's Hospital
-------	---	------------------------------

2019-	Faculty Board, Department of Anesthesiology	Brigham and Women's Hospital
-------	---	------------------------------

National

2014-	Program Director Committee, Representing BWH Pain Medicine Fellowship	American Board of Anesthesiology
-------	---	----------------------------------

2016-	MOCA Minute: Pain Medicine Subcommittee	American Board of Anesthesiology
-------	---	----------------------------------

2022-2022	Program and Evaluation Committee, Summer 2022 Meeting	Eastern Pain Association
-----------	---	--------------------------

2023-2023	Program and Evaluation Committee Chair, Annual Meeting	Eastern Pain Association
-----------	--	--------------------------

Professional Societies:

2007-2012	American Medical Association
-----------	------------------------------

2007-	American Society of Anesthesiologists
-------	---------------------------------------

2007-	Massachusetts Medical Association
-------	-----------------------------------

2007-	Massachusetts Society of Anesthesiologists
-------	--

2011-2019	American Pain Society
-----------	-----------------------

2014-2016	International Spine Intervention Society
-----------	--

2014-	American Academy of Pain Medicine
-------	-----------------------------------

2014-	American Society of Interventional Pain Physicians
-------	--

2016	American Society of Regional Anesthesia
------	---

2016-	North American Neuromodulation Society	
2018-	Boston Pain Society	
2018-		Board of Directors
2023-2025		Co-Director of Fundraising and Industry Relations
2021-	Eastern Pain Association	

Editorial Activities:**Ad hoc Reviewer***Headache Journal**The Journal of Delivery Science and Innovation**Pain Practice**Spine Journal***Other Editorial Roles**

2017	Editor in Chief	Pain Medicine: An Essential Review, 1st Ed. Springer International
2020	Editor	Interventional Management of Chronic Visceral Pain Syndromes, 1st Ed. Elsevier, 2020

Honors and Prizes:

1998	Texas Valedictorian Scholarship, Texas	University of Texas, Austin, TX
2002	Baylor College of Medicine Community Service Scholarship	Baylor College of Medicine, Houston, Texas
2005	Rice University's Jones Graduate School of	Rice University, Jones Graduate School of Management,, Houston, TX

	Management Academic Scholarship	
2011	Distinguished Resident of the Year	Anesthesia Department, Brigham & Women's Hospital, Boston, MA
2011	Foundation for Anesthesia Education and Research (FAER) Practice Management	Resident Scholar Program, Pittsburgh, Pennsylvania
2011	Grant Finalist, Center for Integration of Medicine and Innovative Technology (CIMIT) Research	CIMIT, Boston, MA
2011	National Collegiate Inventors and Innovators Alliance Award for participation in the Ventures Lab	Venture Lab, Cambridge, MA
2011	Young Innovator Award	Harvard School of Engineering & Applied Science, Boston, MA
2013	Distinguished Intraoperative Teaching and Clinical Mentorship	Department of Anesthesiology, Johns Hopkins Hospital, Baltimore, MD
2013	Outstanding Teacher of the Year	Department of Anesthesiology, Johns Hopkins Hospital, Baltimore, MD
2014, 2015, 2016, 2020, 2021	Pain Attending of the Year Award	Department of Anesthesiology, Brigham and

		Women's Hospital, Boston, MA
2014, 2018	Partners in Excellence Award for Leadership and Innovation	Brigham and Women's Hospital, Boston, MA
2018	Outstanding Mentoring Award	Department of Anesthesiology, Brigham and Women's Hospital, Boston, MA
2018	Pain Attending of the Year Award,	Department of Anesthesiology, Brigham and Women's Hospital, Boston, MA
2023	Pain Attending of the Year Award	Anesthesia Department, Brigham & Women's Hospital, Boston, MA

Report of Funded and Unfunded Projects

Past

2015-2019	Prediction of Persistent Post-Mastectomy Pain
Prediction of	NIH (NIGMS); K23 GM110540
Persistent Post-	Co-Investigator (PI: K. Schreiber)
Mastectomy Pain	This project investigates the ability of preoperatively assessed variables including psychosocial evaluation and QST to predict risk of chronic pain after surgery, and allow development of a study enrichment tool to investigate existing and novel perioperative preventive therapies
2016-2018	ReActiv8-B trial
	Mainstay Medical Limited
	Co-Investigator (PI: Christopher Gilligan)
	An international, multi-center, prospective randomized sham-controlled IDE trial at up to 40 clinical trial sites and for 128 randomized subjects to be implanted with an innovative implantable neurostimulation system (Reactiv8). Device is intended to reduce the pain and disability of Chronic Lower Back Pain (CLBP) by helping to restore control to the muscles that dynamically stabilize the lumbar spine

2018-2019	<p>Algovita Post-Market Clinical Study: Spinal Cord Stimulation to Treat Chronic Pain</p> <p>Nuvector Medical</p> <p>PI</p> <p>Multi-center, prospective post market study following patients implanted with Nuvector's Algovita spinal cord stimulator (\$1800 per patient with 10 estimated patients)</p>
2018-2019	<p>Pilot Study to Examine the Feasibility of the DISCSS (Dynamic Interferential Spinal Cord Stimulation System)</p> <p>Meagan Medical Inc</p> <p>PI</p> <p>Multi-center, prospective pilot study following patients using a spinal cord stimulator trial with a novel dynamic interferential system and measuring outcomes compared to traditional stimulation (\$4490 per patient with 10 estimated patients).</p>
2018-2019	<p>Algovita Ultra High Pulse Width Clinical Study: Spinal Cord Stimulation to Treat Chronic Pain</p> <p>Nuvector Medical</p> <p>PI</p> <p>Multi-center, prospective study following patients implanted with Nuvector's Algovita spinal cord stimulator utilizing ultra high pulse width settings (\$1800 per patient with 10 estimated patients).</p>
2019-2020	<p>Clonidine Micropellet Clinical Study for Radiculopathy</p> <p>Sollis Therapeutics, Inc.</p> <p>PI</p> <p>Prospective, multi-center, randomized, double-blinded, sham-controlled study to evaluate the efficacy and safety of clonidine micropellets for the treatment of pain associated with lumbosacral radiculopathy in adults (\$9,633 per patient with 20 estimated patients).</p>
2019-2022	<p>PROLONG Neuromodulation Study for Post Laminectomy Syndrome</p> <p>Abbott</p> <p>PI</p> <p>prospective, multi-center, open-label, post-market study following patients who have failed stimulation previously and are now using BurstDR waveforms or Dorsal Root Ganglion stimulation with restored efficacy (\$ per patient with 10 estimated patients).</p>
2021	<p>RELIEF</p> <p>Boston Scientific</p>

PI (\$25,941)

The primary objective of this study is to compile characteristics of real-world clinical outcomes for Boston Scientific commercially approved neurostimulation systems for pain in routine clinical practice, when used according to the applicable Directions for Use. The secondary objective of this study is to evaluate the economic value and technical performance of Boston Scientific commercially approved neurostimulation systems for pain in routine clinical practice

Current

- 2020- A Phase 3, Randomized, Double Blinded, Active Controlled, Multicenter Study to Evaluate the Efficacy, Safety and Pharmacokinetics of EXPAREL admixed with Bupivacaine vs Bupivacaine only administered as Combined Sciatic (in popliteal fossa) and Adductor Canal Nerve Block for Postsurgical Analgesia in Subjects Undergoing Lower Extremity Surgeries
Co-Investigator (PI: Srdjan Nedeljkovic)
This study will evaluate the efficacy of liposomal bupivacaine when given as a Sciatic (in popliteal fossa) and Adductor Canal nerve block following foot and ankle surgery compared to plain bupivacaine
- 2020- SCOPE Superion Study for Neurogenic Claudication
Boston Scientific
PI (\$40,159.00)
Multi-center, prospective, observational, single-arm, post-approval study to evaluate the Superion interspinous process spacer outcomes in patients with lumbar spinal stenosis resulting in neurogenic claudication
- 2020- SKOAP Sequenced strategy for improving outcomes in people with knee osteoarthritis pain
Co-Investigator (PI: Christopher Gilligan)
There is an urgent public health need to reduce our reliance on opioids for effective long-term pain management, particularly in knee osteoarthritis (KOA). This effectiveness trial will compare recommended treatments to reduce pain and functional limitations in KOA and identify clinical and patient-level factors associated with treatment response. These results will lead to improved patient selection for treatment and inform evidence-based guidelines by offering well-tested, effective, non-opioid alternatives.
- 2020- Dorsal spinal cord STimulation vs medical management for the Treatment of low back pain (DISTINCT)
Abbott BioResearch

Co-Investigator (PI: Christopher Gilligan)

The objective of this study is to evaluate the efficacy of BurstDR™ spinal cord stimulation, compared with conventional medical management, in improving pain and back pain-related physical function in patients suffering with chronic, refractory axial low back pain, who have not had lumbar spine surgery and for whom surgery is not an option.

2022-

From Nerve to Brain: Toward a Mechanistic Understanding of Spinal Cord Stimulation in Human Subjects

NIH - HEAL; NCT05661903; RM1ActNS128741

Co-Investigator (PI: Brian Wainger)

This is a multicenter prospective study of patients who currently have stably implanted spinal cord stimulators. The fundamental hypothesis for this study is that spinal cord stimulators modulate the excitability of primary afferent neurons to reduce pain, and that these changes can be detected by measurement of axonal excitability. This study will use robust, reproducible techniques to define the peripheral, central, and systemic effects of spinal cord stimulators.

2022-

A Phase 3, multi-center, randomized, double-blind, placebo-controlled study, to evaluate the safety and efficacy of SB-01 for injection for the treatment of lumbar degenerative disc disease

Spine BioPharma

PI (\$35,180)

Confirm the safety and effectiveness of SB-01 For Injection in adult patients with chronic low back pain and related disability due to Lumbar Degenerative Disc Disease.

2022-

A Phase 3, Prospective, Multicenter, Randomized, Double-blind, Sham-controlled Study on the Efficacy and Safety of STX-015 in the Treatment of Pain Associated with Lumbosacral Radiculopathy

Sollis Therapeutics, Inc.

Co-Investigator (PI: Srdjan Nedeljkovic)

To compare the efficacy of STX-015 in treating pain at the location associated with the worst lumbar and lumbosacral radiculopathy at Week 12 (3 months) after a single injection of STX-015 into the targeted lumbar or lumbosacral epidural space, compared to that from a blinded, control group of subjects who will undergo a sham injection designed to mimic the actual epidural injection of STX-015.

2023-

Delivery for Pulmonary Arterial Hypertension (PAH)

Medtronic Inc.

Co-Investigator (PI: Aaron Waxman)

The purpose of this clinical trial is to evaluate the safety profile of the Medtronic Model 10642 and Model 8201 Implantable Intravascular Catheter, a component of the PAH Implantable Vasodilator Therapy (PIVoT) system.

Unfunded Current Projects

- 2019- IRB pending Case Series Evaluating the Compliance and Efficacy of Smart Pill-bottles
PI
Single-center, prospective cohort evaluating patient compliance of Bluetooth enabled smart pill dispensers for opioid medication and efficacy of reducing opioid misuse and abuse
- 2020- IRB pending Utilizing a Cadaver-Training Simulator to Teach Interventional Spine Procedures
PI
Single-center, analyzing an innovative approach to educating fellows and residents on interventional spine procedures measuring accuracy, comfort, radiation exposure, and time
- 2022- Prospective Analysis of Health State Utility After Chronic Migraines by Patients Who Experienced This Diagnosis
PI
The primary aim of this study is to quantify the health utility states of people who experienced chronic migraines. Assessing patients' perception of chronic migraine pain will allow us to compare directly with layperson assessment of chronic migraine pain.
- 2023- Prospective Analysis of Health State Utility After Chronic Lower Back Pain by Patients Who Experienced This Diagnosis
PI
The primary aim of this study is to quantify the health utility states of people who experienced chronic low back pain. Assessing patients' perception of chronic low back pain will allow us to improve the understanding of the significance of the diagnosis and provide a quantitative significance to better inform the medical community of the value that should be assigned to efficacious treatments

Report of Local Teaching and Training **Teaching of Students in Courses:**

2011	BUS 2107 Commercializing Science Class Clinical advisor to graduate students	Harvard Business School, Cambridge, MA 1 hour / year
2011	ES227 Medical Device Design Class graduate students	Harvard Graduate School of Engineering, Cambridge, MA 1 hour / year
2011	Introduction to Anesthesia: What does a career in anesthesia look like? medical students	Harvard Medical School 1 hour / week

Formal Teaching of Residents, Clinical Fellows and Research Fellows (post-docs):

2010	Interpretation of an Arterial Blood Gas Critical Care residents, fellows and staff	SICU Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 1 hour / year
2010	Malignant Hyperthermia. Residents/fellows	Sunrise Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 1 hour / year
2011	Hypertension in Pregnancy, OB anesthesia residents	OB Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 1 hour / week
2011-2012	High Yield Board Topics Anesthesia residents	Sunrise Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 1 hour / year 30 minute lecture annually
2012	Complex Regional Pain Syndrome Anesthesia residents, fellows	Sunrise Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 1 hour / week
2012	Complications of Back Surgery Anesthesia fellows	Fellow's Curriculum Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 1 hour / week

2012	Methadone Anesthesia residents, fellows	Sunrise Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 1 hour / week
2012-2013	Acute Pain Management medical students	College Day Lecture Series, Johns Hopkins Hospital, Dept of Anesthesia and Perioperative Medicine 1 hour / year
2012-2013	Cancer Pain medical students	College Day Lecture Series, Johns Hopkins Hospital, Dept of Anesthesia and Perioperative Medicine 1 hour / year
2013	Minimally Invasive Lumbar Decompression, residents, fellows	Pain Management Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 1 hour / week
2013-	Advanced Pain Medicine Department CA-2/3 Residents	BWH Dept. Anesthesia, Perioperative and Pain Medicine 3 hours / year
2013-	Basics of Pain Medicine Department CA-1 Residents	Residency Didactic Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 3 hours / year
2013-	Cancer Pain Medicine Department CA-2/3 Residents (Residency Didactic Lecture Series, BWH Dept. Anesthesia, Perioperative and Pain Medicine 3 hours / year
2015-	Interventional Pain Management Coding and Billing, residents, fellows	Faulkner Pain Management Center Lecture Series, Brigham and Women's Faulkner Hospital, Department of Anesthesia 1 hour / year

Clinical Supervisory and Training Responsibilities:

2012-2013	Supervision Residents and CRNA's	Johns Hopkins Hospital, Department of Anesthesiology 8 hours / week
2013-	Supervision Residents, Fellows, Nurse Practitioners, and Physician Assistants	BWH APPM, Division of Pain Medicine 6 hours / week
2013-	Supervision Residents and CRNA's	BWH APPM, Department of Anesthesiology 2 hours / week

Other Mentored Trainees and Faculty:

2012-2013	Liang Shen, MD / Instructor, Weill Cornell Medical College Career stage: Resident. Mentoring role: Clinical guidance and performance evaluation. Accomplishments: multiple first authored scholarship; Fellowship in Critical Care
2013-2014	Ehren Nelson, MD / Instructor, Brigham and Women's Hospital Career stage: Resident and Fellow. Mentoring role: Clinical guidance, performance evaluation, and academic mentoring. Accomplishments: Multiple national and international invited lectures; Fellowship in Pain Medicine
2014-2015	Isaac Tong, MD / Pain Medicine Attending, San Antonio Career stage: Resident and fellow, Brigham and Women's Hospital. Mentoring role: Faculty mentor during Residency and Pain Fellowship with guidance and performance evaluation Established a strong reputation as a key opinion leader and expert in pain medicine and practice development.
2014-2017	Jessica Hellums, MD / Pain Medicine Fellow, Brigham and Women's Hospital Career stage: Resident. Mentoring role: Faculty mentor during CA-1/2/3 year with guidance and performance evaluation Established a strong reputation as a key opinion leader and expert in pain medicine and practice development.

- 2015-2016 Jeffrey McLaren, MD / Pain Medicine Fellow, Virginia Mason
 Career stage: Resident, Brigham and Women's Hospital.
 Mentoring Role: Faculty mentor during CA-3 year with guidance and performance evaluation
 Established a strong reputation as a key opinion leader and expert in pain medicine.
- 2015-2016 Mona Patel, MD / Pain Medicine Attending, Irvine, California
 Career stage: Fellow, Brigham and Women's Hospital.
 Mentoring role: Faculty mentor during Pain Fellowship with guidance and performance evaluation
 Established a strong reputation as a key opinion leader and expert in pain medicine and academic publications.
- 2015-2018 Brandon Napstad, MD / Anesthesiology Resident, Brigham and Women's Hospital
 Career stage: Resident.
 Mentoring role: Faculty mentor during CA-1-3 year with guidance and performance evaluation
 Established a strong reputation as a clinical anesthesiologist.
- 2016-2017 Victor Wang, MD / Instructor, Brigham and Women's Hospital
 Career stage: Fellow.
 Mentoring role: Faculty mentor during Pain Fellowship with guidance and performance evaluation.
 Accomplishments: Multiple first authored scholarship
- 2016-2019 Andrew Pisansky, MD / Anesthesiology Resident, Brigham and Women's Hospital
 Career stage: Resident.
 Mentoring role: Faculty mentor during CA-1-3 year with guidance and performance evaluation
 Completed a pain fellowship and is now director of acute pain at Vanderbilt with significant academic productivity.
- 2016-2019 David Buric, MD / Anesthesiology Resident, Brigham and Women's Hospital
 Career stage: Resident.
 Mentoring role: Faculty mentor during CA-1-3 year with guidance and performance evaluation
 Completed cardiac and ICU fellowships with significant academic productivity.

- 2017-2018 Fang Fang Xing, MD / Pain Management Fellow, Brigham and Women's Hospital
 Career stage: Fellow.
 Mentoring role: Faculty mentor during Pain Fellowship with guidance and evaluation.
 Accomplishments: multiple first authored scholarship
- 2017-2020 Shafiq Boyaji, MD / Anesthesiology Resident, Brigham and Women's Hospital
 Career stage: Resident.
 Mentoring role: Faculty mentor during CA-1-3 year with guidance and performance evaluation
 Established a strong reputation as a key opinion leader and expert in pain medicine and practice development with academic productivity.
- 2018-2019 Michael Lubrano, MD / Pain Management Fellow, Brigham and Women's Hospital
 Career Stage: Fellow.
 Mentoring role: Faculty mentor during Pain Fellowship with guidance and evaluation.
 Accomplishments: multiple first authored scholarship
- 2019-2020 Bilal Dar, MD / Pain Management Fellow, Brigham and Women's Hospital.
 Career Stage: Fellow
 Mentoring role: Faculty mentor during Pain Fellowship with guidance and evaluation.
 Accomplishments: case reports
- 2019-2022 Kunal Mandavawala, MD – Anesthesiology Resident, Brigham and Women's Hospital.
 Career Stage: Resident.
 Mentoring role: Faculty mentor during CA 1-3 year with guidance and performance evaluation
 Will be completing cardiac and ICU fellowships with significant academic productivity.
- 2020-2023 Michael Fiore, MD, pharmD – Anesthesiology Resident, Brigham and Women's Hospital.
 Career Stage: Resident.
 Mentoring role: Faculty mentor during CA 1-3 year with guidance and performance evaluation

Will be applying for pain with significant research involving medical education.

Formal Teaching of Peers (e.g., CME and other continuing education courses):

☒ *No presentations below were sponsored by 3rd parties/outside entities*

2015	Chronic Venous Insufficiency, Comprehensive Review of Pain Medicine, [Directed by Dr. Edgar Ross. Recorded CME video lecture] sponsored by Oakstone	single presentation Boston
------	--	-------------------------------

Local Invited Presentations:

☒ *No presentations below were sponsored by 3rd parties/outside entities*

2014	Pain Treatment Modalities and Palliative Care for Cognitively Impaired and Terminally Ill Patients / Invited Lecture 2nd Annual Pain Management Lecture, Brigham and Women's Hospital
2014	Spine Views for Interventional Pain Procedures / Invited Lecture Massachusetts Society of Radiologic Technologists, Brigham and Women's Hospital
2016-	Pain Medicine Billing Primer / Invited Lecture Pain Medicine Lecture Series, Brigham and Women's Hospital
2018	Post-operative Pain and the Chronic Pain Patient / Invited Lecture PACU Lecture Series. Brigham and Women's Faulkner Hospital
2022-2022	Peri-operative Pain Management & Chronic Opioid Therapy / Grand Rounds Brigham and Women's Faulkner Hospital, Department of Anesthesiology
2023	Final Words of Wisdom / Invited Lecture BWH Pain Fellow Lecture Series

Report of Regional, National and International Invited Teaching and Presentations

☒ *Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

Regional

- 2015 Advances in Chronic Pain Management / Grand Rounds
Tufts University, Anesthesiology, Boston, MA
- 2021 Opioid Management / Invited Speaker
New Hampshire Medical Society, Conway, NH
- 2023 Spine Interventions: MILD, Spacers, and Stimulation / Invited Lecture
Combined MGH, BWH, BI Ortho Spine Attending Lecture Series

National

- 2013 Perioperative Pain Management, Optimal Anesthesia Management / Invited Lecture
Johns Hopkins Anesthesia Continuing Education, Baltimore, MD
- 2013 Pharmacology of Anesthetics / Invited Lecture
Johns Hopkins Regional Live Meeting Series, Boston
- 2013 Preoperative Patient Assessment / Invited Lecture
Johns Hopkins Regional Live Meeting Series, Boston
- 2015 Cutting Edge Chronic Pain / Grand Rounds
George Washington University, Anesthesiology, Washington, DC
- 2016 Innovation: Treatment and Prescribing Panelist and Moderator, Tennessee
Pain Opioids Problems Solutions Forum / Symposium
Nashville, TN
- 2017 Current Topics in Pain Medicine / Grand Rounds
Kaiser Permanente, Department of Anesthesiology, San Diego, CA
- 2017 Novel Therapies in Pain Medicine / Grand Rounds
Medical University of South Carolina, Department of Anesthesiology,
Charleston, SC
- 2018 On and Off Label Applications for Pain Control / Invited Lecture
NYC Neuromodulation Conference and NANS Summer Series, New York,
NY

2019	Interpretation of Spinal Diagnostic Imaging Studies: Learning a Structured Approach / Invited Speaker American Society of Anesthesiology, Orlando, FL
2020	Lumbar Spinal Stenosis Novel Therapies / Invited Speaker Multi-institution COVID-19 Lecture Series, Sponsored by University of Washington
2020	Peripheral Nerve Stimulation / Invited Speaker American Society of Neuro Radiologists, Las Vegas, NV
2020	Waveform Innovation in Spinal Cord Stimulation / Invited Speaker Multi-institution COVID-19 Lecture Series, Sponsored by University of Washington
2021	Pain Medicine: Practice Management and Billing Compliance University of Miami
2022	Pain Management and Opioid Stewardship OhioHealth
2022	Spinal Cord Stimulation: New Devices and Advances / Invited Lecture Brown University, Medical School, Department of Anesthesiology
2022-2022	Keynote: CDC Opioid Prescribing Guidelines Update – Thoughts, Impacts & Where do we go from here / Keynote Lecture Eastern Pain Association Annual Meeting
2022-2022	Pathophysiology of Pain - A 2022 Update / Invited Lecture Harvard Medical School, Evaluating & Treating Pain Conference Lecture and Panel
2022-2022	Neuromodulation: From Bench to Bedside / Grand Rounds Cedar Sinai, Department of Anesthesiology, Department Grand Rounds
2022-2022	The Digital Transformation of Medicine / Invited Lecture New York City, New York
2023	Neuromodulation Advances / Invited Lecture Brown University, Medical School, Department of Anesthesiology
2023	Invasive Pain Management Techniques / Invited Lecture Medical & Life Care Consulting's 2023 INJURY INSIGHT webinar series This four-part webinar series is designed to educate and inform adjusters,

employers, risk managers, and industry stakeholders of the rehabilitation and recovery process of injuries, illnesses, diagnoses, and treatments, both common and uncommon, within workers' compensation claims.

International

2017	Difficult Airway Management / Anesthesiology Grand Rounds Kanombe Military Hospital, Kigali, Rwanda
2017	Nerve Blocks for Facial Surgery / Anesthesiology Grand Rounds Santa Casa Hospital, Sao Paulo, Brazil
2019	Perioperative Pain Management and Alternatives to Opioids / Invited Speaker Korean American Spine Society Annual Meeting, Vancouver, CA
2019	State of the Art in Interventional Pain Procedures / Invited Speaker Korean American Spine Society Annual Meeting, Vancouver, CA
2023	Prospective Survey of Health Utility State of Chronic Migraine Patients to Assess Quality - Adjusted Life-Years / Platform Presentation European Society of Regional Anesthesiology, Paris, France

Report of Clinical Activities and Innovations

Past and Current Licensure and Certification:

2005-	American Heart Association, Basic and Advanced Cardiac Life Support
2008-	Permanent Licensee, State of Massachusetts
2012-2014	Permanent Licensee, State of Maryland
2012-	Diplomate, American Board of Anesthesiology
2012-	Diplomate, American Board of Anesthesiology Pain Medicine

Practice Activities:

2012-2013	General and regional anesthesia	Johns Hopkins Hospital, Baltimore, MD	40 hours / week
2013	Pain Medicine Physician	Brigham and Women's Hospital, Boston, MA	30 hours / week

2013-	General and regional anesthesia	Brigham and Women's Hospital, Boston, MA	10 hours / week
-------	------------------------------------	---	-----------------

Clinical Innovations:

Cofounder of multidisciplinary spine center / BWF (2014)	As founding medical director of Brigham and Women's Faulkner Hospital's Pain Management Center, a high priority was increased collaboration with the other services in the hospital. After our initial collaboration with the Graham Headache Center proved to be successful, we decided to build a spine center with operative and non-operative services focused on comprehensive spine care. We used a wing of the newly built Orthopedic center at Faulkner to carve out 6 exam rooms and a multi-use work area to build a center where Orthopedics or Neurosurgery was collocated with Physiatry or Pain Medicine. Serving on the governance committee since the inception, I have actively been involved with the creation of workflows, marketing, and management of the spine center. The multi-disciplinary collaboration with physical therapy, pain psychology, rheumatology, neurology, and spine surgery has allowed a focus on developing non-opioid strategies to managing patients suffering with pain.
---	---

Implemented changes for practice efficiency / BWH Pain Ctr (2017)	Because of the significant clinical and financial growth of the Brigham and Women's Faulkner Hospitals Pain Management Center, I was selected to be the Medical Director of Brigham and Women's main Pain Management Center. In this position, I created several processes and work flow changes to improve efficiency. First, I changed the schedule to split out procedures and evaluations into separate sessions. Doing this provided each attending physician dedicated geography and resources to see more patients in less time while reducing wasted footsteps. Next, I worked with Epic to create several shortcuts and orders so providers could quickly enter an order for a procedure which would then automatically enter the work queue for managed care services to obtain prior authorization. The new orders have helped to minimize denials while ensuring the proper time and location are allocated for the desired procedure. I also helped create the new order system providers use to refer patients to our multiple locations of Pain Medicine.
---	--

Creator of new reporting for Pain Management Center / BWH pain Ctr (2017)	Also in my role as Medical Director of Brigham and Women's Pain Management Center, I created two new reports the administration and staff use monthly. The first report is a gaps analysis to determine sessions where we have inadequate provider coverage. The second report is a productivity report that marries our billing database with the scheduling system to provide the physicians aggregate productivity data that can then be drilled down into individual days. The report is now used by attending physicians
---	---

to track their productivity and by the finance division to cross verify their reporting measures.

Introduction of Radiofrequency Identification to measure time driven activity based costing / (2018)	In collaboration with MIT and Harvard Business School I am coordinating the implementation of radiofrequency identification (RFID) tags and readers to more accurately and robustly calculate costs of a given activity using time driven activity based costing (TDABC). The current models utilizing TDABC in healthcare rely on manual recordings of each step in an activity. Utilizing RFID would minimize the measurement bias and allow for a larger sample size.
--	--

Report of Teaching and Education Innovations

Co-founder for the Faulkner Lecture Series (2014)	I co-created a lecture series for the Pain Medicine fellows. In the lecture series, we invite lecturers from other specialties including orthopedics, radiology, psychiatry, and law to discuss practical concepts in Pain Management to prepare them for their early careers. The feedback from the fellows is superb and an integral part of their education.
--	---

Creator and manager of Faulkner Hospital Pain rotation (2016)	Since founding the Brigham and Women's Faulkner Hospital's Pain Management Center in 2013, we have been asked to host rotation for interns, residents, and fellows. Each year we have a growing number of residents requesting the rotation for the CA-3's pain medicine elective – even for residents not specializing in Pain Medicine. Additionally, we now host Neurology Headache fellows, Regional Anesthesia fellows, and categorical anesthesia interns. I coordinate and evaluate all rotating trainees through the Pain Center.
--	---

Introduction of pain simulation (2018-)	Simulation in anesthesiology is now a standard for resident education, however, within Pain Medicine simulation has not gained traction. I worked with a company called Biotras to bring a spine simulator with cadaveric bone and ballistic gel to the Pain Management Center at Brigham and Women's Hospital. We organized two sessions for the 2018-2019 fellow class to practice obtaining the correct views and directing the needle for four of our most common procedures. The feedback was so overwhelmingly positive from the fellows that we curated an entire curriculum based on simulation. We have published on our findings demonstrating improvements in fellow comfort, accuracy, radiation exposure, and time for each procedure. Every year we have incrementally added new ad-hoc session in the second half of each fellowship year.
---	---

Report of Education of Patients and Service to the Community

☒ *No presentations below were sponsored by 3rd parties/outside entities*

Activities

1999	Medical Mission Medical mission to Guatemala with Sending Out Servants
2000-2002	Big Brothers Big Sisters Over 500 hours spent as a mentor in Austin, TX
2000-2002	Habitat for Humanity Habitat for Humanity via Texas Blazers
2010	Global Smile Foundation Medical Mission to Cote D'Ivoire, Global Smile Foundation (Anesthesiologist)
2011	Global Smile Foundation Medical Mission, Ecuador with the Global Smile Foundation (Anesthesiologist)
2012, 2015	Global Smile Foundation Medical Mission, Guatemala with the Global Smile Foundation (Anesthesiologist)
2017	Face the Future Foundation Medical Mission, Rwanda with Face the Future (Anesthesiologist)
2017	Global Smile Foundation Medical Mission, Brazil with Global Smile Foundation (Anesthesiologist)
2018, 2019	Face the Future Foundation Medical Mission, Rwanda with Face the Future Foundation (Anesthesiologist)

Educational Material for Patients and the Lay Community:***Patient educational material***

2015	Managing with Low Back	BWF, Community Lecture Series
2016	Novel Techniques for Treating Low Back Pain	BWF, Community Lecture Series

Recognition:

2010	Featured in Brigham and Women's Hospital Bulletin	12/13/2010 article: Driving Clinical Innovations at BWH
2011	Featured in the Harvard Gazette (September 20, 2011) Surgical Precision at SEAS	9/20/2011 article: Innovation and Medical Device Design
2016	Featured in Tennessean (April 5, 2016)	4/5/2016 article: Health care leaders urge action on opioid abuse
2016	Highlighted in educational marketing video for Brigham and Women's Hospital	5/6/2016 video: Managing Back Pain
2016	Highlighted in marketing video for Faulkner Hospital Pain Management Center	5/12/2016 video: Pain Management Center at BWFH

Report of Scholarship

ORCID: 0000-0001-6960-9621

Peer-Reviewed Scholarship in print or other media:**Research Investigations**

1. Brattain LJ, Floryan C, Hauser OP, Nguyen M, **Yong RJ**, Kesner SB, Corn SB, Walsh CJ. Simple and effective ultrasound needle guidance system. Annu Int Conf IEEE Eng Med Biol Soc. 2011;2011:8090-8093. PMID: 22256219, <https://doi.org/10.1109/IEMBS.2011.6091995>
2. **Yong RJ**, Nelson ER, Urman RD, Kaye AD. A primer for billing in interventional pain management. J Med Pract Manage. 2015;30(6 Spec No):51-54. PMID: 26062319
3. Imran TF, Malapero R, Qavi AH, Hasan Z, de la Torre B, Patel YR, **Yong RJ**, Djousse L, Gaziano JM, Gerhard-Herman MD. Efficacy of spinal cord stimulation as an adjunct therapy for chronic refractory angina pectoris. Int J Cardiol. 2017 Jan 15;227:535-542. PMID: 27836302, <https://doi.org/10.1016/j.ijcard.2016.10.105>
4. Kim AJ, **Yong RJ**, Urman RD. The Role of Transversus Abdominis Plane Blocks in Enhanced Recovery After Surgery Pathways for Open and Laparoscopic Colorectal Surgery. J Laparoendosc Adv Surg Tech A. 2017 Sep;27(9):909-914. PMID: 28742435, <https://doi.org/10.1089/lap.2017.0337>

5. Pak DJ, **Yong RJ**, Kaye AD, Urman RD. Chronification of Pain: Mechanisms, Current Understanding, and Clinical Implications. *Curr Pain Headache Rep*. 2018 Feb 5;22(2):9. PMID: 29404791, <https://doi.org/10.1007/s11916-018-0666-8>
6. Xing F, **Yong RJ**, Kaye AD, Urman RD. Intrathecal Drug Delivery and Spinal Cord Stimulation for the Treatment of Cancer Pain. *Curr Pain Headache Rep*. 2018 Feb 5;22(2):11. PMID: 29404792, <https://doi.org/10.1007/s11916-018-0662-z>
7. Aman, M.M., Jason Yong, R., Kaye, A.D.*et al*.Evidence-Based Non-Pharmacological Therapies for Fibromyalgia.*Curr Pain Headache Rep***22**, 33 (2018). <https://doi.org/10.1007/s11916-018-0688-2>
8. Simopoulos T, **Yong RJ**, Gill JS. Treatment of Chronic Refractory Neuropathic Pelvic Pain with High-Frequency 10-kilohertz Spinal Cord Stimulation. *Pain Pract*. 2018 Jul;18(6):805-809. PMID: 29106051, <https://doi.org/10.1111/papr.12656>
9. Wang VC, Preston MA, Kibel AS, Xu X, Gosnell J, **Yong RJ**, Urman RD. A Prospective, Randomized, Double-Blind, Placebo-Controlled Trial to Evaluate Intravenous Acetaminophen Versus Placebo in Patients Undergoing Robotic-Assisted Laparoscopic Prostatectomy. *J Pain Palliat Care Pharmacother*. 2018;32(2-3):82-89. PMID: 30645153, <https://doi.org/10.1080/15360288.2018.1513436>
10. Novak CJ, Khimani N, Kaye AD, Jason Yong R, Urman RD. Current Therapeutic Interventions in Lower Extremity Venous Insufficiency: a Comprehensive Review. *Curr Pain Headache Rep*. 2019 Mar 4;23(3):16. doi: 10.1007/s11916-019-0759-z. PMID: 30830460
11. Valimahomed AK, Haffey PR, Urman RD, Kaye AD, **Yong RJ**. Regenerative Techniques for Neuraxial Back Pain: a Systematic Review. *Curr Pain Headache Rep*. 2019 Mar 11;23(3):20. PMID: 30854599, <https://doi.org/10.1007/s11916-019-0758-0>
12. Morales A, **Yong RJ**, Kaye AD, Urman RD. Spinal Cord Stimulation: Comparing Traditional Low-frequency Tonic Waveforms to Novel High Frequency and Burst Stimulation for the Treatment of Chronic Low Back Pain. *Curr Pain Headache Rep*. 2019 Mar 14;23(4):25. PMID: 30868285, <https://doi.org/10.1007/s11916-019-0763-3>
13. Atkinson TJ, Pisansky AJB, Miller KL, **Yong RJ**. Common elements in opioid use disorder guidelines for buprenorphine prescribing. *Am J Manag Care*. 2019 Mar 1;25(3):e88-e97. PMID: 30875177
14. Boyaji S, Merkow J, Elman RNM, Kaye AD, **Yong RJ**, Urman RD. The Role of Cannabidiol (CBD) in Chronic Pain Management: An Assessment of Current Evidence.

Curr Pain Headache Rep. 2020 Jan 24;24(2):4. PMID: 31980957,
<https://doi.org/10.1007/s11916-020-0835-4>

15. Coppes OJM, **Yong RJ**, Kaye AD, Urman RD. Patient and Surgery-Related Predictors of Acute Postoperative Pain. Curr Pain Headache Rep. 2020 Feb 18;24(4):12. PMID: 32072315, <https://doi.org/10.1007/s11916-020-0844-3>
16. Costelloe C, Burns S, **Yong RJ**, Kaye AD, Urman RD. An Analysis of Predictors of Persistent Postoperative Pain in Spine Surgery. Curr Pain Headache Rep. 2020 Feb 18;24(4):11. PMID: 32072357, <https://doi.org/10.1007/s11916-020-0842-5>
17. Merkow J, Varhabhatla N, Manchikanti L, Kaye AD, Urman RD, **Yong RJ**. Minimally Invasive Lumbar Decompression and Interspinous Process Device for the Management of Symptomatic Lumbar Spinal Stenosis: a Literature Review. Curr Pain Headache Rep. 2020 Feb 18;24(4):13. PMID: 32072362, <https://doi.org/10.1007/s11916-020-0845-2>
18. Blevins Peratikos M, Weeks HL, Pisansky AJB, **Yong RJ**, Stringer EA. Effect of Preoperative Opioid Use on Adverse Outcomes, Medical Spending, and Persistent Opioid Use Following Elective Total Joint Arthroplasty in the United States: A Large Retrospective Cohort Study of Administrative Claims Data. Pain Med. 2020 Mar 1;21(3):521-531. PMID: 31120529, PMCID: PMC7060398, <https://doi.org/10.1093/pm/pnz083>
19. Li L, **Yong RJ**, Kaye AD, Urman RD. Perioperative Point of Care Ultrasound (POCUS) for Anesthesiologists: an Overview. Curr Pain Headache Rep. 2020 Mar 21;24(5):20. PMID: 32200432, <https://doi.org/10.1007/s11916-020-0847-0>
20. Morales ME, **Yong RJ**. Racial and Ethnic Disparities in the Treatment of Chronic Pain. Pain Med. 2021 Feb 4;22(1):75-90. PMID: 33367911, <https://doi.org/10.1093/pm/pnaa427>

Cited 63 time as of 5/2023

21. Henson JV, Varhabhatla NC, Bebic Z, Kaye AD, **Yong RJ**, Urman RD, Merkow JS. Spinal Cord Stimulation for Painful Diabetic Peripheral Neuropathy: A Systematic Review. Pain Ther. 2021 Dec;10(2):895-908. PMID: 34244979, PMCID: PMC8586096, <https://doi.org/10.1007/s40122-021-00282-9>
22. **Yong RJ**, Mullins PM, Bhattacharyya N. Prevalence of chronic pain among adults in the United States. Pain. 2022 Feb 1;163(2):e328-e332. PMID: 33990113, <https://doi.org/10.1097/j.pain.0000000000002291>

Cited 162 times as of 5/2023

23. Mullins, Peter M.; Yong, Robert J.; Bhattacharyya, Neil. Impact of demographic factors on chronic pain among adults in the United States. PAIN Reports 7(4):p e1009, July/August 2022. | DOI: 10.1097/PR9.0000000000001009
24. Sarno D, **Yong RJ**, Fields KG, Lim SM, Gilligan CJ, Khan L, Nelson, E. "A Novel Interventional Pain Simulation-Based Education Curriculum: Implementation to Enhance Procedural Training" Interventional Pain Medicine Volume 1, Issue 4, Dec 2022
25. Mullins PM, **Yong RJ**, Bhattacharyya N. Associations between chronic pain, anxiety, and depression among adults in the United States. Pain Pract. 2023 Mar 7. doi: 10.1111/papr.13220. PMID: 36881021.
26. Gilligan C, Burnside D, Grant L, **Yong RJ**, Mullins PM, Schwab F, Mekhail N. ReActiv8 Stimulation Therapy vs. Optimal Medical Management: A Randomized Controlled Trial for the Treatment of Intractable Mechanical Chronic Low Back Pain (RESTORE Trial Protocol). Pain Ther. 2023 Apr;12(2):607-620. PMID: 36787013, PMCID: PMC10036695, <https://doi.org/10.1007/s40122-023-00475-4>
27. "Fluoroscopic MBBs and RFA for Facet-Mediated Low Back Pain" New England Journal of Medicine In Press.

Other peer-reviewed scholarship

1. Rohan Jotwani, Michael Fiore, Robert Jason Yong, David Hao; Virtual reality for procedural education: Lumbar medial branch radiofrequency neurotomy, Interventional Pain Medicine, Volume 1, Issue 1, 2022, 100088, ISSN 2772-5944, <https://doi.org/10.1016/j.inpm.2022.100088>. (<https://www.sciencedirect.com/science/article/pii/S2772594422000796>)

Non-peer reviewed scholarship in print or other media:

Reviews, chapters, and editorials

1. **Yong RJ**, Nedeljkovic S. Assessment of pain: Patient evaluation. In: Pocket Pain Medicine, Urman RD, Vadivelu N (eds), Philadelphia: Lippincott

2. Tong I, **Yong RJ**. Pain Emergencies: Averting catastrophe through diagnosis and treatment. In: Fundamentals of Pain Care. Oxford University Press, 2015
3. Smith J, **Yong RJ**, Nedeljkovic S. “Minimally Invasive Treatments for Spinal Stenosis: Percutaneous Lumbar Decompression.” Surgical Pain Management. Oxford University Press, 2016
4. Yazdi C, **Yong RJ**, Nguyen, M. “Endovenous Ablation.” Surgical Pain Management. Oxford University Press, 2016
5. Lockhart B, **Yong RJ**. Pharmacology of Pain Transmission and Modulation. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.147-148.
6. Patel M, **Yong RJ**. Corticosteroids. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.181-184
7. Tong I, **Yong RJ**. “Sacroiliac Joint Pain.L5 Dorsal Ramus and S1-S3 Lateral Branch Radiofrequency Ablation. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.245-248
8. Tong YCI, **Yong RJ**. Cervical Facet Injections/Medial Branch Block. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.227-230
9. Tong YCI, **Yong RJ**. Lumbar Medial Branch Radiofrequency Lesioning. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.237-240
10. Tong YCI, **Yong RJ**. Lumbar Transforaminal Epidural Steroid Injection. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.223-226
11. Tong YCI, **Yong RJ**. Sacroiliac Joint Injection. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.241-244
12. **Yong RJ**, Nelson E. “Interlaminar Epidural Steroid Injection: Cervical and Lumbar. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.219-222

13. **Yong RJ**, Issa M. Thoracic facet pain/medial branch blocks.. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.231-232
14. **Yong RJ**, Issa M. Tricyclic antidepressants. In: Pain Medicine: An Essential Review, RJ Yong, Nguyen M, Nelson E, Urman RD (eds), 1st Ed. Switzerland: Springer International Publishing, 2017; p.165-166
15. Saba R, **Yong RJ**, Gilligan C, Rathmell J. Emergencies in the Pain Clinic. In: Bonica's Management of Pain, Ballantyne JC, Fishman SM, Rathmell JP (eds), 5th Ed. Philadelphia: Lippincott, Williams & Wilkins, 2018
16. Tong YC, **Yong RJ**, Hogans BB, Booker SQ, Herr KA. Pain in Older Patients. Pain Care Essentials. Oxford University Press. 11/01/2019; DOI: 10.1093/med/9780199768912.003.0020
17. Lubrano M, Costelloe C, **Yong RJ**. Local Anesthetics and Scalp Blocks. In: Hair Transplant Surgery and Platelet Rich Plasma: Evidence-based Essentials, Lee LN (ed), 1st Ed. Switzerland: Springer International Publishing, 2020, chap 8
18. Tong I, **Yong RJ**, Hogans BB. Pain Emergencies and Life-threatening Complications of Pain Treatments. In: Pain Care Essentials, 1st Ed. Oxford University Press, 2020, chap 13
19. Lubrano, M.C., Costelloe, C.C., Yong, R.J. (2020). Local Anesthesia and Scalp Blocks. In: Lee, L.N. (eds) Hair Transplant Surgery and Platelet Rich Plasma. Springer, Cham. https://doi.org/10.1007/978-3-030-54648-9_8
20. Boyaji, S., Gilligan, C.J., Hirsch, J.A., Yong, R.J. (2020). Evidentiary Basis of Percutaneous Discectomy. In: Manfrè, L., Van Goethem, J. (eds) The Disc and Degenerative Disc Disease. New Procedures in Spinal Interventional Neuroradiology. Springer, Cham. https://doi.org/10.1007/978-3-030-03715-4_8
21. Brook, A.L., Boyaji, S., Gilligan, C.J., Hirsch, J.A., Yong, R.J. (2020). Epidural Steroid Injections: Are They Still Useful?. In: Manfrè, L., Van Goethem, J. (eds) The Disc and Degenerative Disc Disease. New Procedures in Spinal Interventional Neuroradiology. Springer, Cham. https://doi.org/10.1007/978-3-030-03715-4_7
22. He C, **Yong RJ**. Chronic Postsurgical Pain. Interventional Management of Chronic Visceral Pain Syndromes, Pak DJ, **Yong RJ**, Shah KB (eds), Elsevier, 2021.
23. Mehta AD, **Yong RJ**. Chronic Pancreatitis. Interventional Management of Chronic Visceral Pain Syndromes, Pak DJ, **Yong RJ**, Shah KB (eds), Elsevier, 2021.

24. Zerriny S, **Yong RJ**. Chronic Mesenteric Ischemia. Interventional Management of Chronic Visceral Pain Syndromes, Pak DJ, **Yong RJ**, Shah KB (eds), Elsevier, 2021.

Books/textbooks for the medical or scientific community

1. RJ Yong, Nguyen M, Nelson E, Urman RD. Pain Medicine: An Essential Review, 1st Ed. Switzerland: Springer International Publishing, 2017
2. Pak D, Yong J, Shah K. Interventional management of chronic visceral pain syndromes. 1st edition, Missouri: Elsevier, 2021

Professional educational materials or reports, in print or other media:

1. Yong R. Brigham and Women's Anesthesia Residency Wiki. BWHAneesthesia.org, 2011
2. Yong R. Brigham and Women's Pain Fellow's Wiki. BWHAneesthesia.org, 2011
3. Yong, RJ www.TheAnswerPage.Com, A web-based daily educational resource for medical professionals. A web-based daily educational resource for medical professionals. Eleventh Annual Medical Education Day, Harvard Medical School, Boston, MA, 2012
4. Yong, RJ. TheAnswerPage.com. Pain, Palliative Care, Opioid Prescribing and Risk Management: The Answer Page, Inc; 2012
5. **Yong RJ**. Cancer Pain: in Pain, Palliative Care, Opioid Prescribing & Risk Management: The Answer Page, Inc. 2015.
6. **Yong RJ**. Cannabidiol Therapy in Cancer Pain and Management: Florida Physicians Low -THC Cannabis Course: Florida Medical Association, Inc 2015

Abstracts, Poster Presentations, and Exhibits Presented at Professional Meetings:

1. **Yong RJ**, Sarno D, Velez M. Resolution of Chronic Debilitating Headaches and Lumbar Radicular Pain Following Spinal Cord Stimulation and Interspinous Process Decompression: A Case Report. North American Neuromodulation Society, 2020.
2. Fiore M, Galanti G, Park B, Lim S, **Yong RJ**, Gilligan C, Nelson E. Virtual Reality Augmentation to a Pain Medicine Simulation Curriculum. American Academy of Pain Medicine, 2021.

3. Mukherjee V, **Yong RJ**, Janardhanan D, Nelson ER, Zhao E, Gilligan CJ. Interventional Management of Thoracic Pain Secondary to Malignant Pleural Effusion: A Case Report. American Academy of Physical Medicine and Rehabilitation 2021 Annual Assembly – Pain and Spine Medicine. Annual Meeting; Nashville, TN
4. Vu K, Pappy A, Berlin E, Yang A, Sarno D, Nelson E, **Yong RJ**. Comprehensive Simulation Sessions for Interventional Spine Procedure: Preliminary Prospective Results. Spine Intervention Society Annual Meeting, 2022. Poster Session
5. Burns S, Majdak P, **Yong RJ**, Barreveld A. Dorsal Root Ganglion Stimulation For Patients with Chronic Pelvic Pain: A Retrospective Case Series. American Academy of Pain Medicine Annual Meeting, 2023.
6. Mullins P, Regenhardt S, **Yong RJ**. Acute Unscheduled Care Use Among Adults with Chronic Pain: Results from the National Health Interview Survey. American Academy of Pain Medicine Annual Meeting, 2023.
7. Eckley MJ, Vu K, Yih ET, **Yong RJ**, Nelson ER, Pappy AL, Scott B, Hunter T, Gureck A, Reilly AC, Burns SL, Sarno DL. (poster) Simulation-based education: a novel grading rubric to assess performance of interventional pain procedures. AAPM Annual Meeting, Fort Lauderdale, FL, March 2023.
8. Mallett B, Ogletree S, **Yong RJ**. A Stim Without a Rose: Neurologic Recovery post-SCS Explant. ASIPP Annual Conference, 2023. Poster Session.
9. Gureck A, Vu K, Eckley MJ, Hunter T, Yih ET, **Yong RJ**, Nelson ER, Pappy AL, Scott B, Reilly AC, Burns SL, Lee KW, Sarno DL. Simulation-based education to improve procedural skills in spinal cord stimulation and dorsal root ganglion stimulation. Poster presentation at the 2023 American Society of Regional Anesthesia and Pain Medicine Meeting in New Orleans, LA.

* Co-author, ** Mentee

Narrative Report

As an academic anesthesiologist specializing in pain medicine at Brigham and Women's Hospital, my efforts are focused on developing clinical expertise, innovating pain medicine through novel implantable devices and opioid management strategies, and educating fellows and residents. My major supporting activity involves administrative and institutional service with leadership roles and committee service.

Approximately half of my time is devoted to direct patient care within pain medicine including time spent evaluating patients in clinic, performing office-based procedures, and surgically implanting devices to help manage pain. I spend twenty percent of my time as an anesthesiologist supervising

residents and nurse anesthetists with a focus on regional anesthesia and acute post-operative pain management. The remainder of my time is divided among administrative duties including institutional committee service and serving as the Associate Chief of Pain Medicine and Medical Director of the Pain Management Center.

Clinically, I have developed expertise in surgically implantable technologies for the treatment of chronic pain and opioid management strategies. Since fellowship, I have been fascinated by neuromodulation using spinal cord and peripheral stimulators to modulate pain signals. Using this passion, I have taught fellows and residents extensively on the technology, and introduced the Nevro high frequency stimulator to Brigham and Women's Hospital becoming the first implanting physician in New England. Since then I have continued as the major pioneering physician for other minimally invasive procedures in New England, such as Vertiflex Superior spacer implantation, Relieva Intracorporeal, Saluda neuromodulation, Mainstay Reactiv8, Vertos MILD. I have tried to maintain an academic focus with new technology, and I am currently the Principal Investigator in several prospective case-series examining the efficacy of novel neuromodulation technologies. With my focus on neuromodulation, I have been fortunate enough to become the top planter of spinal cord stimulators in the Northeast.

I am continuing to develop my career in research and have several active funded clinical studies involving neuromodulation and novel therapeutics. The unfunded project involve evaluating the health utility of different pain states, medical education utilization a novel pain simulator, and analyzing epidemiology of pain. In response to my personal struggles and those of fellows starting their careers, I conceptualized and was first editor for Pain Medicine: An Essential Review which focuses on relevant clinical pearls. I have published on several different topics within pain medicine and have a current H-index of 16 with a first authored paper titled Prevalence of chronic pain among adults in the United States cited over 300 times since publication in 2022. On a national level, I have been invited to give 5 grand rounds and was invited to serve on the American Board of Anesthesiology MOCA Minute for Pain Medicine question writing committee. Internationally, I participate in 1-2 medical missions per year providing anesthesia and have been invited to give multiple international presentations.

As the founding medical director of the Pain Management Center at Brigham and Women's Faulkner Hospital, I helped grow the pain medicine services at the hospital focusing on the integration of high quality pain management to all areas of the hospital. Our volume tripled to over 400 pain patients per month in the span of 3 years. Due in part to that success, in 2017, I was selected as the Medical Director of the Pain Management Center at Brigham and Women's Hospital. In this role, I am focused on operational efficiency and financial viability. With the early changes I helped manage and develop, our productivity has increased with an improvement in patient satisfaction. The rapid turnaround then led to the appointment as Associate Chief of the Division of Pain Medicine. I was also elected to serve on the Faculty Board in the Department of Anesthesiology. I serve as an active member on the Faculty Recruitment Committee and the Anesthesiology Social Committee.

In my current role and as the previous Associate Program Director for the Pain Management Center at Brigham and Women's Hospital, I am involved with recruitment, curriculum development, and overall management of the 10 fellows per year. My involvement in this role extends to committee service on a hospital and national level with the American Board of Anesthesiology. As a product of our own

residency and fellowship, I am appreciative of the extensive curriculum and mentorship by the world renown experts at our institution. I have strived to reciprocate using innovative teaching methods such as the introduction of medical simulation with pain procedures, and I am honored to have my passion in mentorship and teaching reflected in the Pain Fellow's Pain Attending of the Year award for excellence in teaching for 7 of the previous 10 years.

In addition to my clinical work, I have been an active member in our department and the hospital. I was elected to serve on the Medical Staff Executive Committee for Brigham and Women's Faulkner Hospital and currently serve on the Ambulatory Advisory Council at Brigham and Women's Faulkner Hospital and the Office for Multicultural Careers Advisory Committee at the Brigham and Women's Hospital.